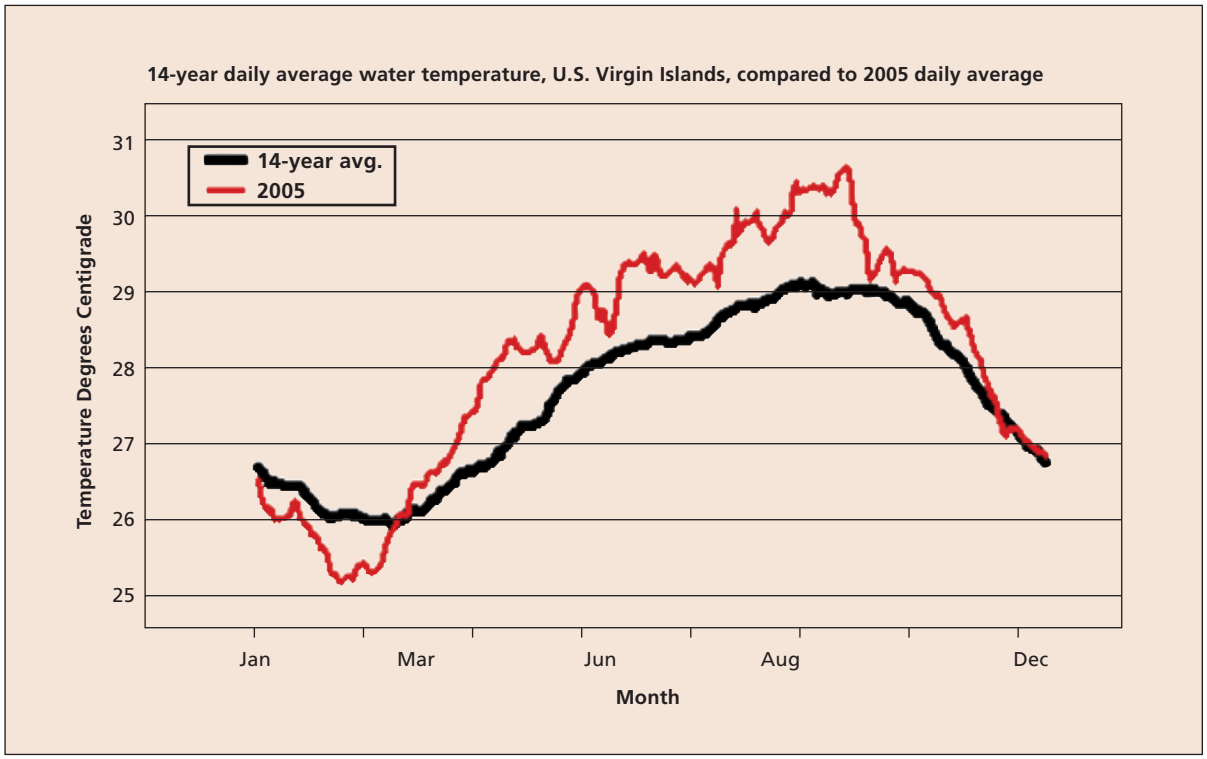
Coral reef monitoring offers case study for identifying monitoring assessment points

By Matt Patterson

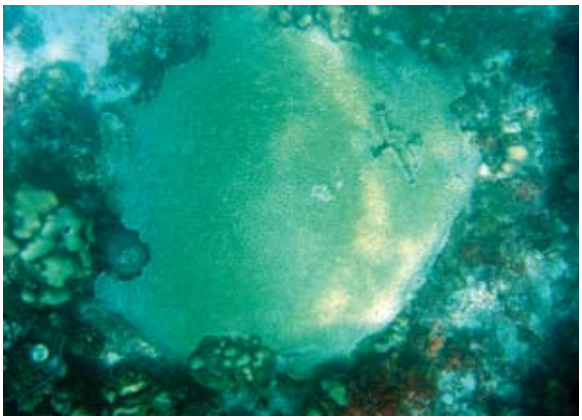
NATIONAL PARKS ARE PLACES OF SPECTACULAR beauty, but beauty is not a sufficient indication of the condition of park resources. Park managers need accurate information about the plants, animals, and natural systems in their care in order to make sound management decisions and undertake adaptive management activities to respond to adverse changes. For this reason the National Park Service's (NPS) Vital Signs Monitoring Program organizes approximately 270 park units into 32 monitoring networks to conduct long-term monitoring for key indicators of ecosystem health, or vital signs. The NPS Vital Signs Monitoring Program is grappling with identifying assessment points for each vital sign. Assessment points establish benchmarks that are used to alert park managers to changes in resource conditions that may suggest the need for different management prescriptions. In 2005 and 2006, changes in ocean temperatures off the U.S. Virgin Islands affected coral reefs in two national park units and provided NPS scientists a case study for identifying an assessment point for coral reef monitoring.

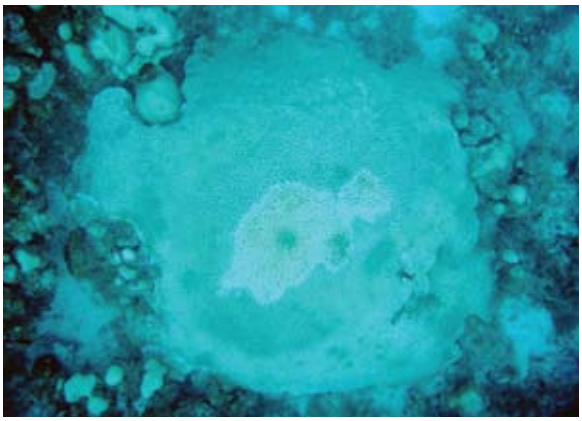
In 2005 and 2006 the South Florida/Caribbean Inventory and Monitoring Network faced an unprecedented increase in oceanic water temperatures; over this period water temperatures exceeded the previous 14-year average in the U.S. Virgin Islands. These higher temperatures were driven primarily by 2005 weather patterns that caused tropical storms to miss the U.S. Virgin Islands. Without storm-induced cloud cover and high winds to mix the ocean, water temperatures rose. This elevation led network staff to increase monitoring of coral reef resources at Virgin Islands National Park and Buck Island Reef National Monument in order to detect the temperature-induced stress responses of the coral reef community.

As water temperatures rose from April through September 2005, monitoring teams visited a subset of high, stony coral reef sites every few months to track the extent of coral bleaching. Under normal conditions, scientists would visit these sites annually, but in 2005 they were alerted to the need for more frequent monitoring



Bleaching occurs when the coral animals experience a 2- to 3-degree Centigrade increase in water temperature that is sustained for days to weeks. As water temperature rose in 2005, network staff monitored transects at Virgin Islands National Park and Buck Island Reef National Monument more frequently, tracking the progression of bleaching to an eventual 90% of stony corals along the transects.





Over many months, divers documented a decline in the condition of stony corals, including this large brain coral (*Colpophyllia natans*), pictured here at Tektite reef, from healthy in August 2005 (top) to bleached in September 2005 (middle). In December 2005 this coral head began to recover from bleaching, but disease, visible as the bright white skeleton (bottom), attacked the top of the head.

as the result of analyzing historical mean water temperatures in U.S. Virgin Islands waters and detecting significant increases. Monitoring network staff understood that with higher seawater temperatures, coral bleaching, or the discharge of the coral animal's symbiotic plant cells, or zooxanthellae, might reduce the coral's ability to survive because of decreased internal food production. In this case an increase in water temperature was the assessment point that resulted in closer evaluation of coral reef resources.

Assessment points could become important management tools for alerting park managers to changes that require intervention on their part to preserve park resources.

More frequent monitoring allowed network staff to document a coral bleaching event that affected more than 90% of the stony corals. It also revealed that recovery and disease transmission rates varied by coral species and colony shape. Staff documented the widespread presence of coral disease, which unfortunately ravaged the already weakened corals, and the subsequent mortality of more than 50% of the live coral cover at the monitored reef sites. Management practices that could alleviate this loss throughout the two park units are not available yet.

Assessment points may require different management actions and need to be addressed early in park planning. For example, some assessment points may trigger an administrative action (e.g., no new permits issued for backcountry access), and others may require outreach to educate people in the region to help mitigate an impact (e.g., water conservation during a drought, or no ground fires permitted during high fire danger). Many other assessment points, including increased water temperatures in the U.S. Virgin Islands, may call for expanded monitoring, which could include examining variables that may help to better understand the problem, more frequent monitoring to ensure documentation of a highly dynamic event, and broader spatial-scale monitoring to document spread rates or the extent of the problem. Any management response may require lengthy public review, so management should consider how to address regulatory compliance requirements when changes in management activities are dictated by crisis situations.

Developing assessment points without a complete understanding of the natural variability of vital signs necessitates concerted effort. Science and the expertise of NPS professionals help determine when increased monitoring is necessary. As the National Park Service continues to gain experience in monitoring, assessment points could become important management tools for alerting park managers to changes that require intervention on their part to preserve park resources. ■

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